



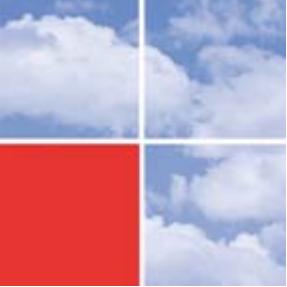
Glass Industries Inc.

# **Windows Requirements in the Residential Energy Codes**

**2005 National Workshop**

**on**

**State Building Energy Codes**  
**Austin, TX**



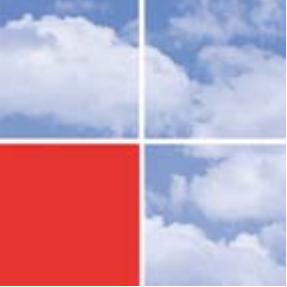
# Window Metrics

- U-Factor
- Solar Heat Gain Coefficient (SHGC)
- Air Leakage (AL)

# Window Ratings

- National Fenestration Rating Council
- Required for U-Factor since 1995 MEC
- Required for SHGC since 1998 IECC

 National Fenestration Rating Council® <b>CERTIFIED</b>	<b>World's Best Window Co.</b> Millennium 2000+ Vinyl-Clad Wood Frame Double Glazing • Argon Fill • Low E Product Type: Vertical Slider
<b>ENERGY PERFORMANCE RATINGS</b>	
U-Factor (U.S./I-P) <b>0.35</b>	Solar Heat Gain Coefficient <b>0.32</b>
<b>ADDITIONAL PERFORMANCE RATINGS</b>	
Visible Transmittance <b>0.51</b>	Air Leakage (U.S./I-P) <b>0.2</b>
Condensation Resistance <b>51</b>	—
Manufacturer stipulates that these ratings conform to applicable NFRC procedures for determining whole product performance. NFRC ratings are determined for a fixed set of environmental conditions and a specific product size. NFRC does not recommend any product and does not warrant the suitability of any product for any specific use. Consult manufacturer's literature for other product performance information. <a href="http://www.nfrc.org">www.nfrc.org</a>	

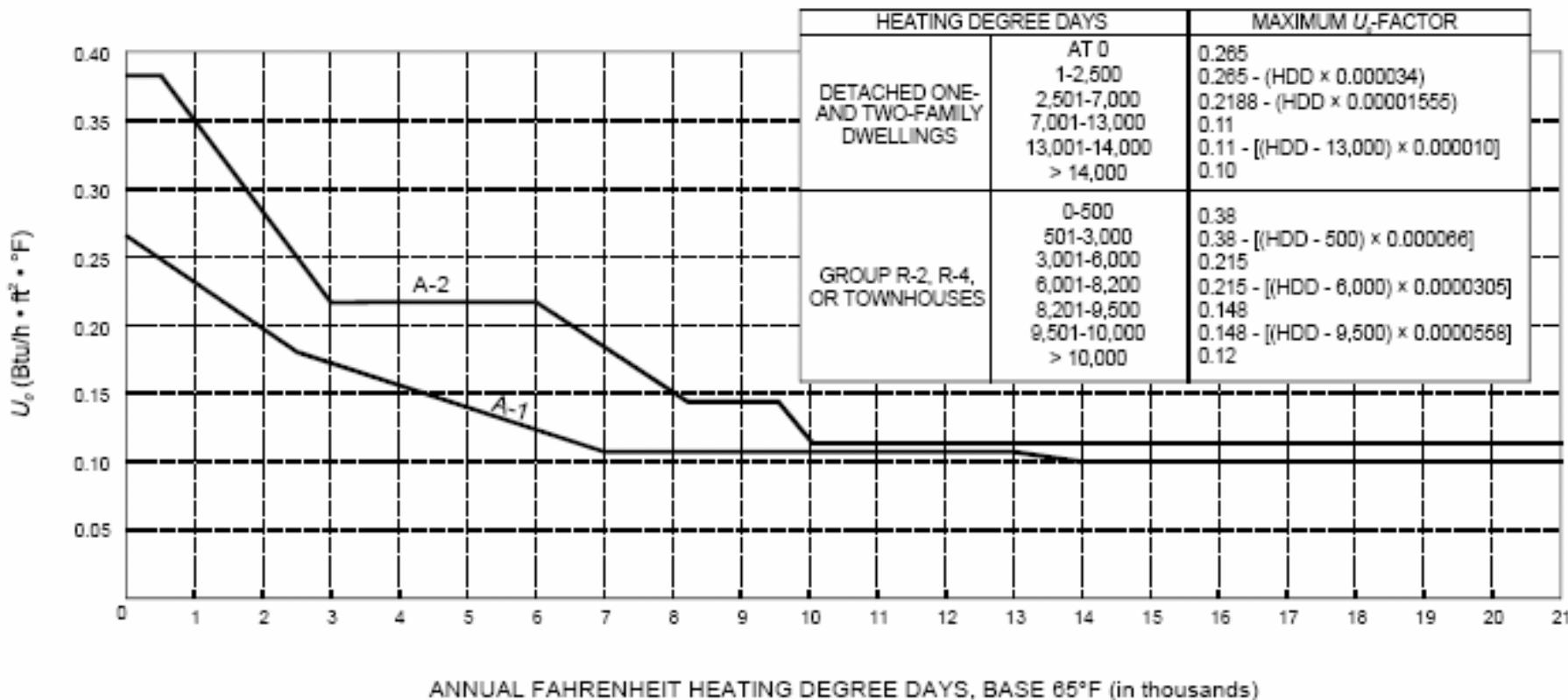


# MEC & Windows

- No prescriptive requirements
- Window U-Factor buried in wall  $U_o$

$$U_o = \frac{(U_w \times A_w) + (U_g \times A_g) + (U_d \times A_d)}{A_o}$$

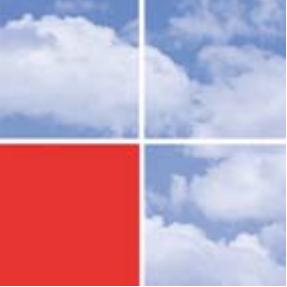
# MEC Wall U-Factor



ANNUAL FAHRENHEIT HEATING DEGREE DAYS, BASE 65°F (in thousands)

For SI: 1 Btu/h · ft<sup>2</sup> · °F = 5.678W/(m<sup>2</sup> · K), °C = [(°F)-32]/1.8.

FIGURE 502.2(1)  
 $U_o$ -FACTORS—WALLS: RESIDENTIAL BUILDINGS



# MEC

- Default U-Factors for non-rated windows added in 1995
- No requirements for window solar control

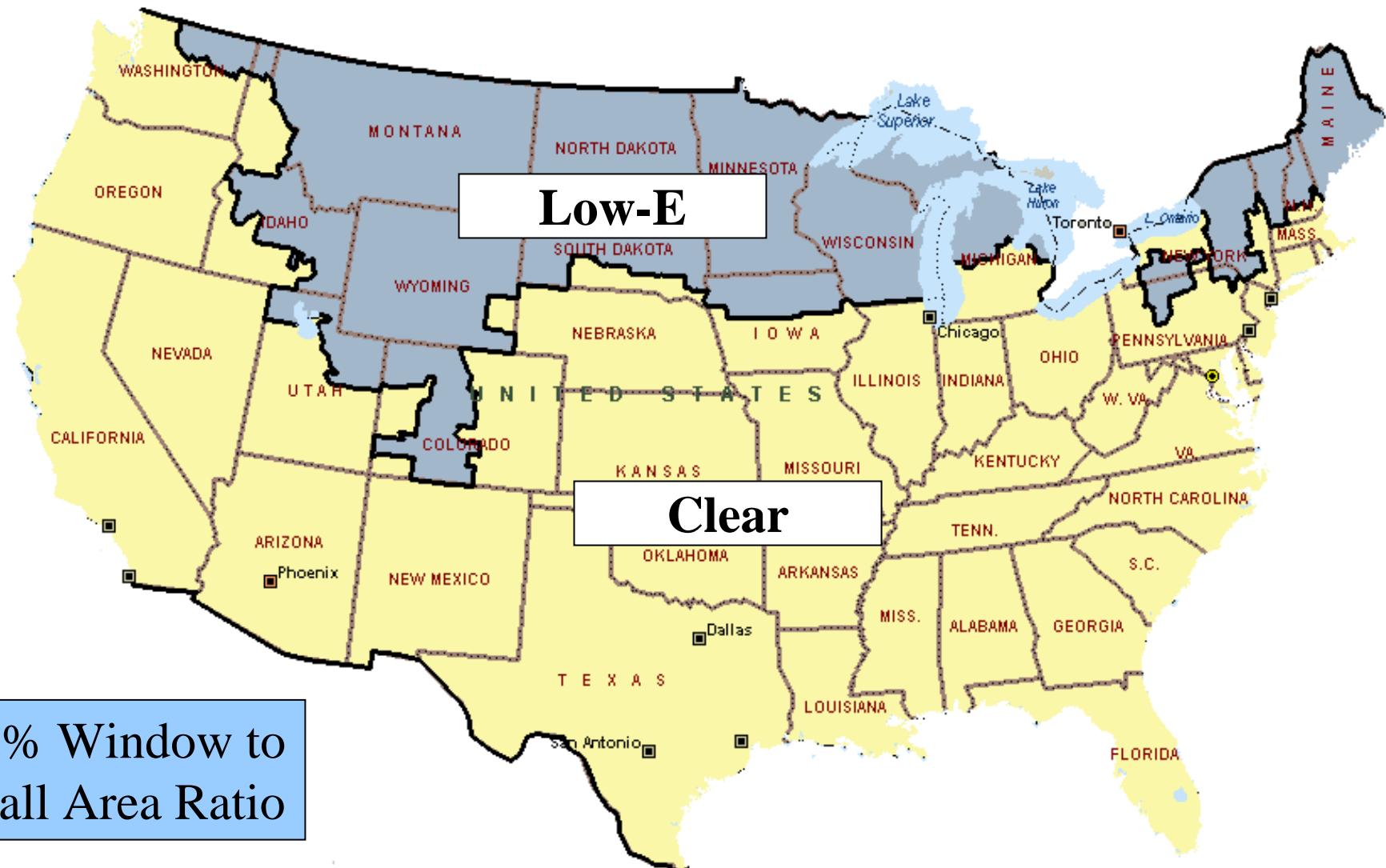
TABLE 102.3a  
U-VALUE DEFAULT TABLE FOR WINDOWS,  
GLAZED DOORS AND SKYLIGHTS

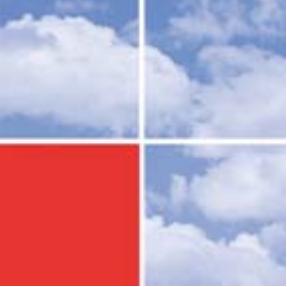
	SINGLE GLAZED	DOUBLE GLAZED
<b>METAL WITHOUT THERMAL BREAK</b>		
Operable	1.30	0.87
Fixed	1.17	0.69
Door	1.26	0.80
Skylight	1.92	1.30
<b>METAL WITH THERMAL BREAK</b>		
Operable	1.07	0.67
Fixed	1.11	0.63
Door	1.10	0.66
Skylight	1.93	1.13
<b>METAL-CLAD WOOD</b>		
Operable	0.98	0.60
Fixed	1.05	0.58
Door	0.99	0.57
Skylight	1.50	0.88
<b>WOOD/VINYL</b>		
Operable	0.94	0.56
Fixed	1.04	0.57
Door	0.98	0.56
Skylight	1.47	0.85

For SI: 1 inch = 25.4 mm.

Glass block assemblies shall have a *U*-value of 0.60.

# Approximate Window Requirements from MEC Wall Uo





# IECC: 1998, 2000, and 2003

- Added tables of prescriptive U-Factors
- Added SHGC requirements in the south
- Added NFRC rating of SHGC
- Added default SHGC for non-rated windows
- Replacement windows added in 2000

# IECC Window U-Factors: Type A-1

Climate	Window to Wall Area Ratio							Replacement	SHGC
	Zone	8%	12%	15%	18%	20%	25%		
17	0.42	0.40	0.35	0.33	0.30	0.25	0.35	--	--
16	0.42	0.40	0.35	0.33	0.30	0.25	0.35	--	--
15	0.42	0.40	0.35	0.33	0.30	0.25	0.35	--	--
14	0.43	0.40	0.35	0.33	0.30	0.25	0.35	--	--
13	0.45	0.40	0.35	0.34	0.31	0.25	0.35	--	--
12	0.45	0.45	0.40	0.37	0.33	0.27	0.40	--	--
11	0.52	0.45	0.45	0.37	0.36	0.29	0.40	--	--
10	0.55	0.50	0.45	0.37	0.37	0.33	0.40	--	--
9	0.59	0.55	0.45	0.40	0.37	0.37	0.40	--	--
8	0.65	0.60	0.50	0.46	0.42	0.41	0.50	--	--
7	0.70	0.60	0.55	0.50	0.46	0.45	0.50	0.40	
6	0.70	0.60	0.60	0.52	0.50	0.46	0.50	0.40	
5	0.90	0.65	0.65	0.55	0.52	0.50	0.50	0.40	
4	any	0.75	0.75	0.65	0.60	0.52	0.75	0.40	
3	any	0.75	0.75	0.70	0.70	0.55	0.75	0.40	
2	any	any	0.90	0.75	0.75	0.65	0.75	0.40	
1	any	any	any	0.80	0.80	0.70	0.75	0.40	

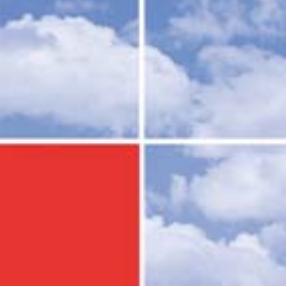
# IECC Window U-Factors: Type A-2

Climate Zone	Window to Wall Area Ratio				
	20%	25%	30%	Replacement	SHGC
17	0.35	0.35	0.32	0.35	--
16	0.35	0.35	0.32	0.35	--
15	0.35	0.35	0.32	0.35	--
14	0.45	0.45	0.38	0.35	--
13	0.50	0.51	0.44	0.35	--
12	0.50	0.51	0.44	0.40	--
11	0.50	0.52	0.45	0.40	--
10	0.50	0.53	0.45	0.40	--
9	0.55	0.54	0.46	0.40	--
8	0.55	0.55	0.46	0.50	--
7	0.55	0.55	0.47	0.50	0.40
6	0.55	0.55	0.47	0.50	0.40
5	0.70	0.70	0.57	0.50	0.40
4	0.85	0.85	0.65	0.75	0.40
3	any	any	0.70	0.75	0.40
2	any	any	0.75	0.75	0.40
1	any	any	0.90	0.75	0.40

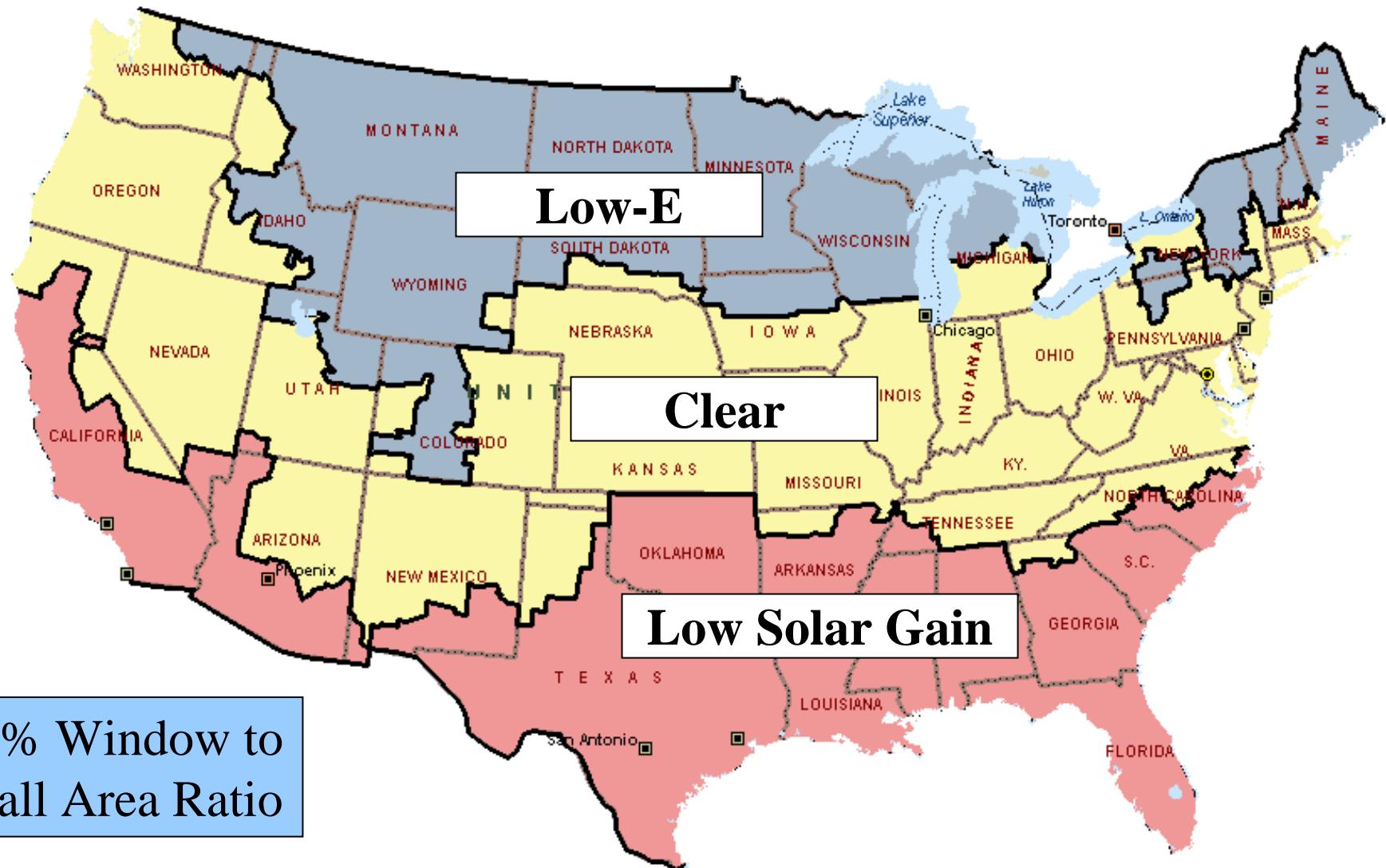


# IECC: 170 Prescriptive Combinations

- (17) climate zones
- (6) window to wall areas for type A-1
- (3) window to wall areas for type A-2
- (1) replacement set
- Different requirements for Performance Path!!!



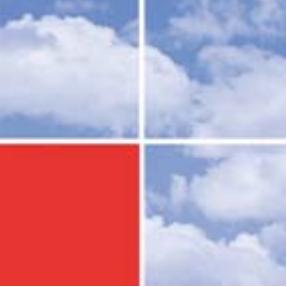
# IECC 1998-2000 Prescriptive Window Requirements





# The Big Change: 2004 Supplement

- No window to wall area requirements
- Simplified table of prescriptive requirements applies to single & multi-family
- Performance path baseline and replacement windows tied to Prescriptive

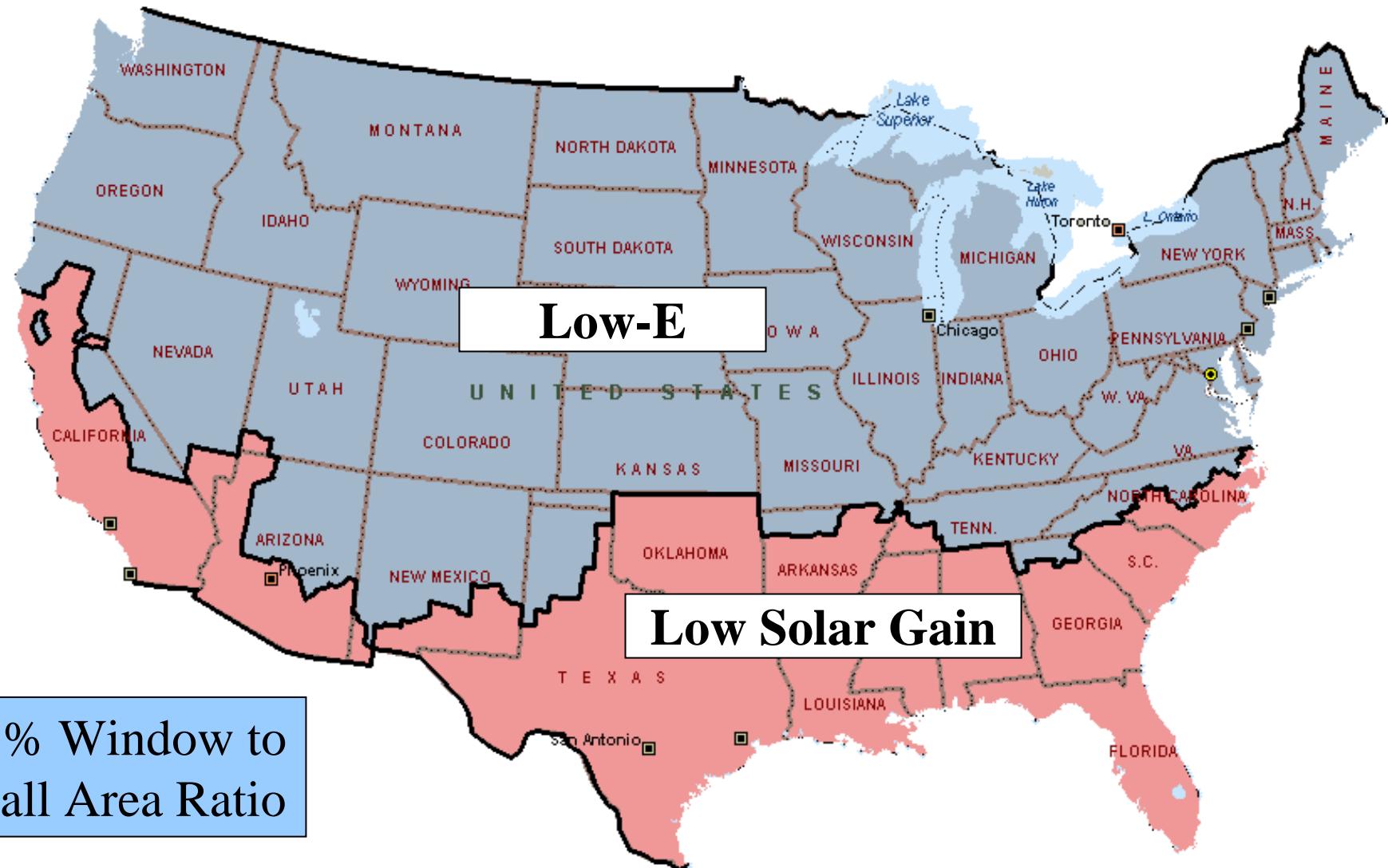


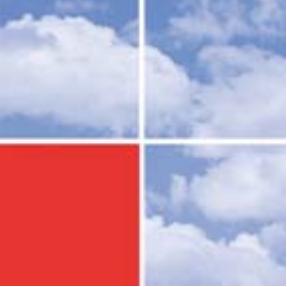
# 2004 IECC Window Requirements

Climate Zone	U-Factor	SHGC
7	0.35	--
6	0.35	--
5	0.35	--
4	0.40	--
3	0.65	0.40
2	0.75	0.40
1	1.20	0.40

# IECC 2004+

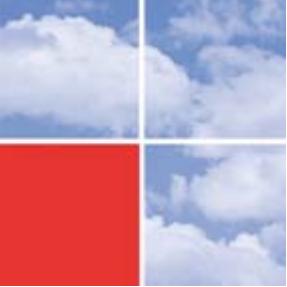
## Prescriptive Window Requirements





# Dis-Advantages to Eliminating Window ÷ Wall Area

- Change is hard
- It's less accurate
- More training is needed
- You can build an all glass house



# Advantages to Eliminating Window ÷ Wall Area

- It's easy to understand & enforce
- It will promote market transformation
- It saves energy nationally
- Every room is comfortable!